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(54) Bag making machine

(57) A bag making machine comprises a brushless electronically controlled drive motor 31, arranged to drive a draw roller 25 to draw a flattened tube or prefolded sheet of plastics film through the machine, and a second motor 33 driving a cam 32 arranged to operate a sealing knife 27 once during each cam rotation. The motors are controlled by a control means including a micro-processer in such a way that in each cam cycle, the motor 31 is rotated during half the cycle and the cam is positioned angularly to operate the sealing knife 27 when the film is at rest. A detector 23 is provided to detect registration marks on the film and the control means compensates for any inaccuracies by slightly under or over driving the roller 25. The microprocesser is preprogrammed with basic data concerning the lengths of feed paths in the machine, and other fixed characteristics, and can be programmed for each operation with variable data concerning e.g. the bag length and operating speed.

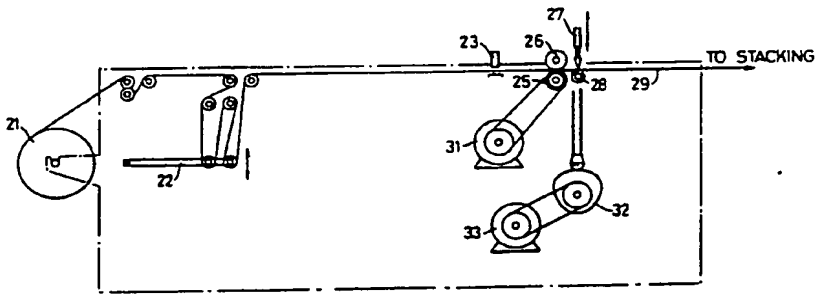

Fig. 2

GB 2 221 422 A

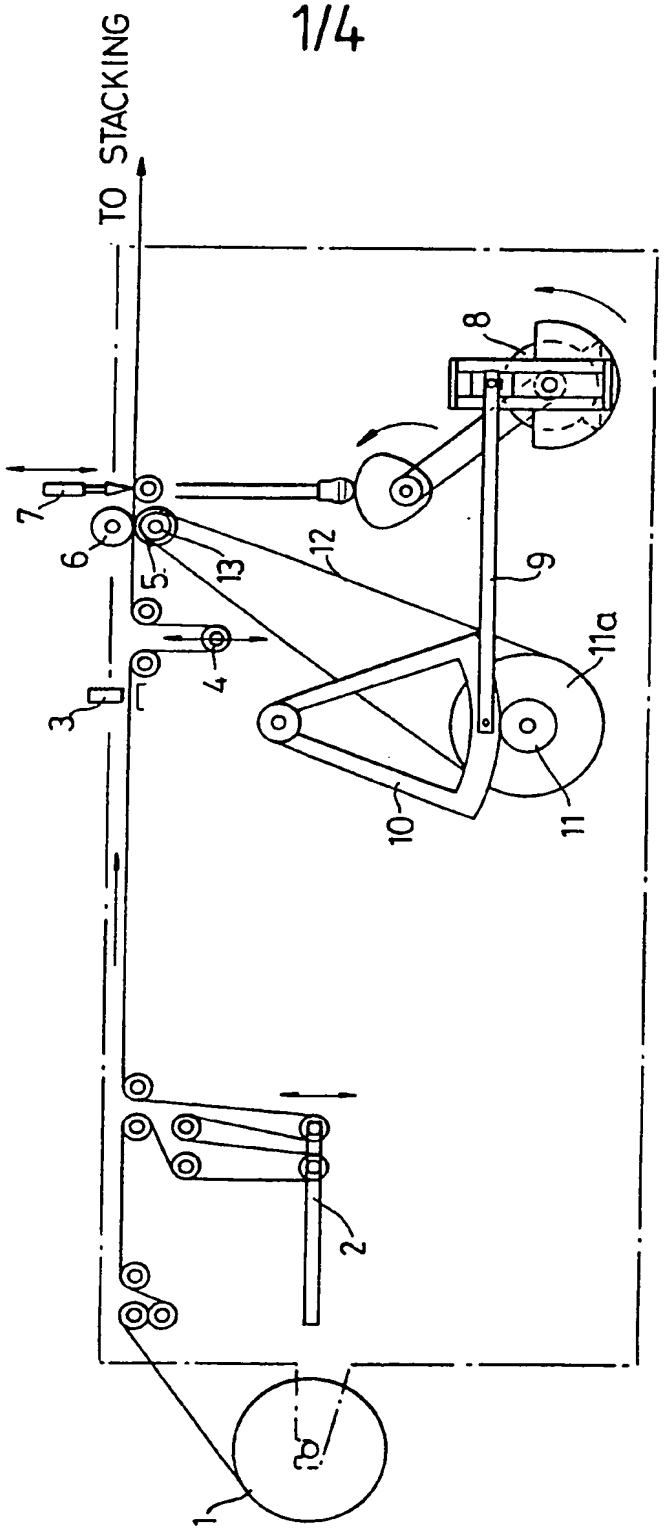

Fig. 1

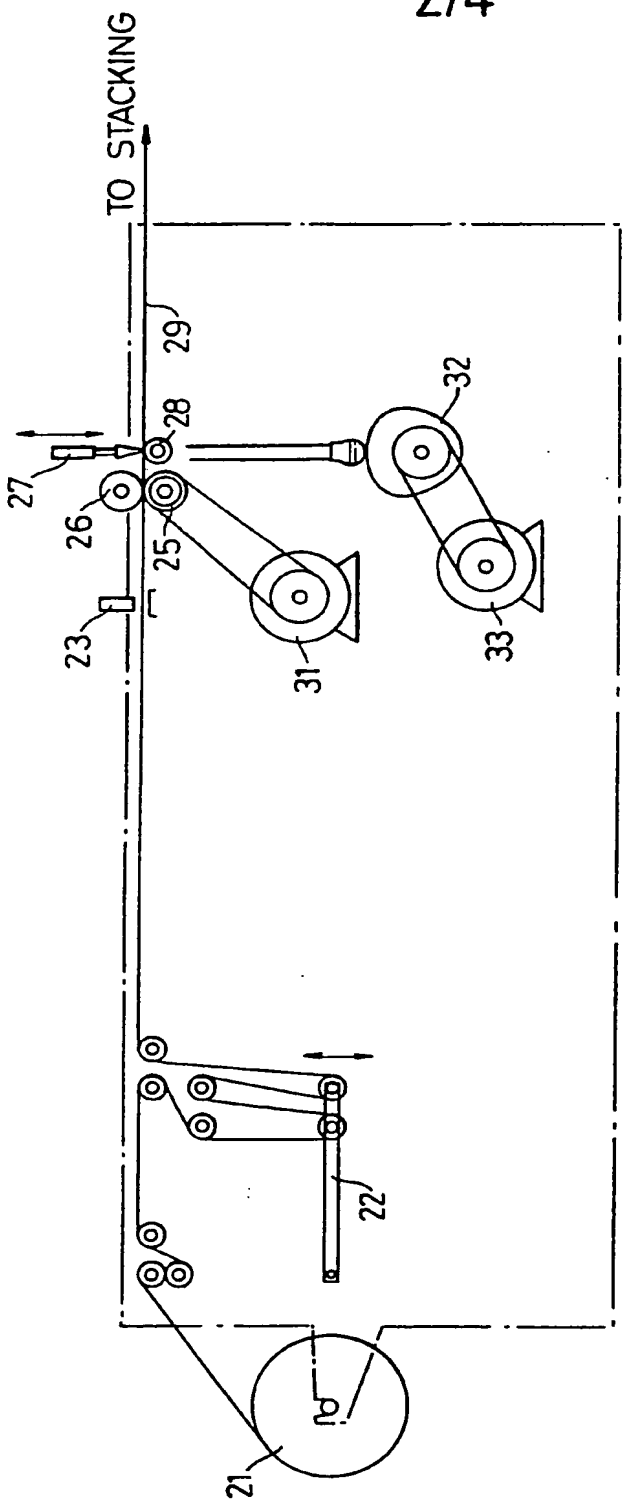

Fig. 2

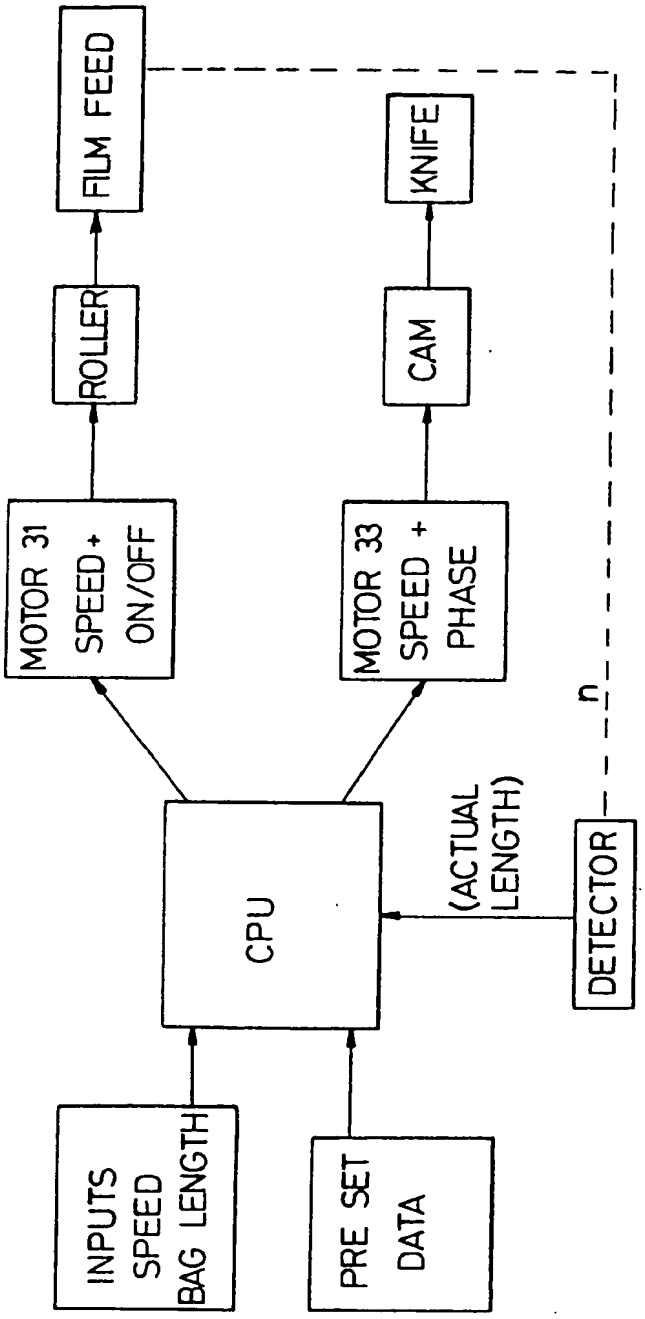
FILM FEED
KNIFE
ROLLER
CAM
MOTOR 31
SPEED +
ON/OFF
MOTOR 33
SPEED +
PHASE
n
CPU
(ACTUAL
LENGTH)
DETECTOR
INPUTS
SPEED
BAG LENGTH
PRE SET
DATA

Fig. 3

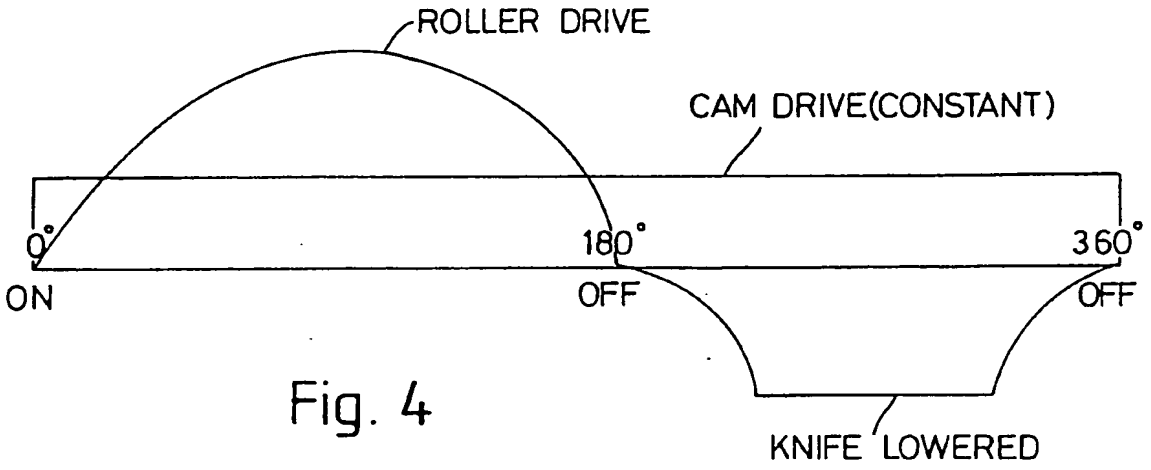
ROLLER DRIVE
CAM DRIVE(CONSTANT)
0°
180°
360°
ON
OFF
OFF
KNIFE LOWERED

Fig. 4

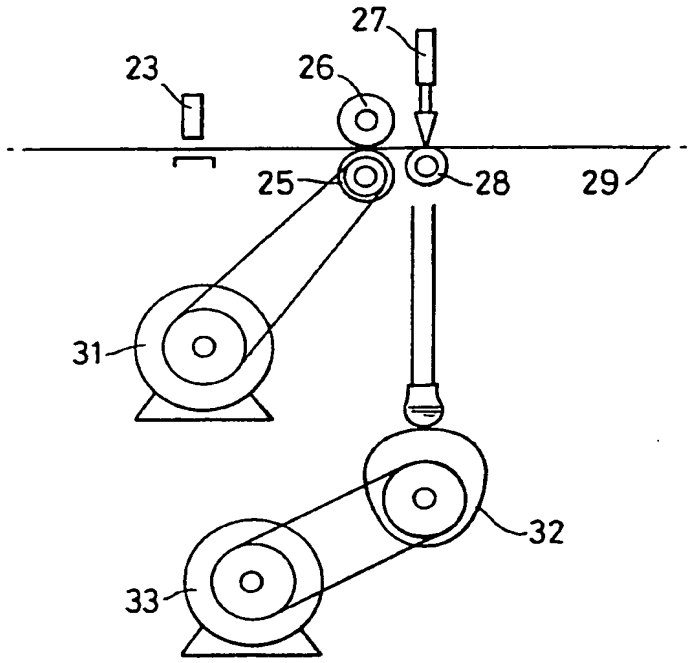
27
23
26
25
28
29
31
32
33

Fig. 5

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Bag Making Machine

This invention relates to improvements in bag-making machinery.

Bags of thermoplastics film, such as polyethylene, often referred to as 'polybags' are made from a flattened tube or prefolded sheet of film, by cutting and heat sealing the tube at spaced intervals by a heated knife. This produces a succesion of film bags which are open at one end and sealed at the other. Where the film is preprinted with labels, Trademarks, or descriptive matter, it is necessary to synchronise the operation of the knife with the spacing of the labels.

In a state-of-the-art machine, illustrated diagrammaticaly in Fig. 1 of the accompanying drawings, a roll of flattened tubular polyethylene film 1, preprinted with labels, and with registration or dividing marks, is fed through an array of tension compensating rollers 2, passed below a photocell detector 3, and over a further length compensator loop and roller 4 to a nip formed by rollers 5 and 6, to a heated sealing and cutting knife 7. The tension compensator array 2 ensures that the desired tension in the film is maintained, and the detector 3 detects the passage of the dividing marks or registration marks. The length compensator 4 is adjustable to ensure that the number of bag lengths between the detector 3 and the knife 7 is an integral, so that the labels are correctly placed on the resulting bags. The drive of the known machine comprises a motor 8 which rotates an arm 9 connected by a rod the position of which on the arm is adjust-

able, to provide the throw required for required for the bag length. The rod is connected to one end of the rim of a geared segment 10 which engages by meshing teeth with a gear 11. Rotation of the arm 9 causes reciprocation of the rod, and swinging of the segment 10, thus driving the gear 11 first clockwise, then anticlockwise. A chain 12 from a larger sprocket 11a rotationally integral with gear 11, drives a gear 13 on the roller 5 which transmits the drive to the roller through a clutch. The clutch acts in one direction so that when the sprockets are driven clockwise, the roller 5 is advanced entraining the film; on the return stroke. however, the roller 5 is left stationary, the clutch over-riding the anti-clockwise rotation of the sprocket, and the roller being arrested by an electromagnetic brake on the other trunnion of the roller. The film is thus not drawn through the roller nip. The knife 7 is operated by a cam arrangement from the motor 8 while the film is not moving.

The machine is set up for operation by adjustment of the length of the arm 9 and of the depth of the compensator loop 4 to allow for alteration of the length between registration marks in different series of bags. This operation proceeds by trial and error, and may take in the order of up to half an hour, with possible waste of a substantial amount of film in trial runs.

An object of the present invention is to provide an improved machine for making plastics bags which can be set up quickly with a minimum of waste through trial runs, and

offers improved flexibility in control and operation.

A machine according to the invention therefore comprises conveyor means for feeding a flattened tube or prefolded sheet of plastics film to a draw roller which is arranged to be intermittently driven, a sealing knife arranged to be operated when the draw roller is undriven, and detector means for detecting registration marks on the film, characterised in that the draw roller is driven by an electronically controlled brushless electric motor, which is switched on and off in response to a control programme and synchronised with the operation of the knife, to effect intermittent drive of the draw roller and ensure that the roller is undriven at the moment of operation of the sealing knife.

The sealing knife may be driven from a second motor via a cam geared to run synchronously with the cycle of the draw roller, and synchronised therewith to operate the knife in the non-rotating phase of the draw roller cycle.

The motors are preferrably controlled and synchronised by a micro-processer, which is preprogrammed with set instructions and basic parameters, and can be programmed at each operation with new values of variable data such as bag length and production rate.

Brushless electronically commutated electric motors are highly suitable for this use as they allow instantaneous switching and control, and provide integral electromagnetic braking of the roller.

A preferred embodiment of plastics film bag making machine according to the invention will now be described with reference to the accompanying drawings, wherein:-

Fig. 1, already referred to, is a diagrammatic side view of a prior art bag making machine;

Fig. 2 is a similar view of a bag making machine according to the invention;

Fig. 3 is a flow diagram of the control functions processed by the control means;

Fig. 4 is a phase diagram of the operation of the driven roller and the sealing knife; and

Fig. 5 is an enlarged diagram of the drive arrangement.

A bag making machine according to the invention is illustrated in Fig. 2. Film, in the form of a flattened tube or prefolded sheet is fed from a roll 21 about a festoon of tension compensating rollers 22, and on a conveyor below a detector in the form of a photocell 23 to a nip comprising a lower driven roller 25 and an idling upper roller 26. The entrainment of the film from roll 21 to a sealing knife 27, which is placed behind the rollers 25, 26 is effected by the driven roller 25. Sealing knife 27 is heated to carry out the steps of sealing and cutting the film in one operation to create each bag in turn; and has an anvil roller 28 below it. From the knife 27 the cut bags are taken by a conveyor 29, made up of a plurality of ribbons each preferrably in the order of 10 cm. in width, to a stacking station where the bags are made up into stacks of predetermined numbers, and removed.

The roller 25 is arranged to be driven through a belt drive by a brushless electric motor 31, and the knife 27 is operated by a cam 32 belt driven by a further motor 33, synchronously with motor 31. The detector 23 detects registration marks printed on the film for the purpose of ensuring that the bags are cut at the places required for correct placing of pre-printed matter such as labels. The signals thus generated by the detector operate via a control means 34 to synchronise the operation of the motor 31 and drive to roller 25, and of motor 33 and the operation of knife 27, with the spacing of the labels on the film, and to keep them in phase with respect to the machine cycle.

The control means is operative to switch the motor 31 on at the beginning and off half way through each operating cycle, and the motor 33 is driven at a constant speed all through the cycle to produce one rotation per cycle, with the cam 32 positioned angularly to operate the knife 27 when the motor 31 is 'off' and the film stationary over the anvil roller 28. The operation is controlled to relate the draw length of the roller to the repeat length of the label printing and the rate of the machine, in relation to the measured length between registration marks, so that the drive places the film correctly on the anvil roller at the end of each entrainment step for operation of the knife.

The control means includes a microprocesser which is pre-programmed to control the motors 31 and 32, and has basic data in permanent form concerning e.g. the separation of the

detector from the knife, and the ratio of motor turns to entrained film length.

Before each use of the machine, the variable data relating to the batch to be processed is entered, such as the length of film between cuts, and print registration offset. The rate of operation of the machine, and draw speed of film through the machine is determined by the microprocesser. Overrides are provided to enable an operator to reduce or increase the operating rate by a fixed proportion at each actuation of the overrride, and to enable an emergency stop to be effected.

The preprogrammed machine speed determines the speed of motor 33, which then remains constant until the speed instruction is altered. The switching of motor 31 is in direct relationship to this setting. The detector 23 sends a control signal to the draw roller motor 31 and in doing so the microprocesser corrects any error or drift in the following bag by driving the draw roller slightly further or less as required. After a run (say 10) of missed print marks, the machine shuts down. This guards against side slipping of the film. The detector operates as a corrector device, and is used for preprinted material only. For unprinted material, the detector is not used.

Use of electronic control makes the machine suitable for remote monitoring of production and reliability as well as of machine failure, of a plurality of machines from a central location.

Setting up the machine to produce a batch of bags can be accomplished in a few minutes, including a number of trial runs, as compared with the time in the order of up to half an hour for the prior art machine.

Claims

1. A machine for making plastics bags comprising conveyor means for feeding a flattened tube or prefolded sheet of plastics film to a draw roller arranged to be driven intermittently, a sealing knife arranged to be operated when the roller is undriven, and a detector for detecting registration marks on the film, characterised in that the draw roller is driven by an electronically controlled brushless electric motor, which is switched on and off in response to a control programme and synchronised with the operation of the knife, to effect intermittent drive of the draw roller, and ensure that the roller is undriven at the moment of operation of the sealing knife.

2. A machine according to Claim 1, wherein the sealing knife is driven from a second continuously running motor via a cam, said cam being geared to run synchronously with the cycle of the draw roller, and synchronised therewith to operate the knife in the non-rotating phase of the draw roller cycle.

3. A machine according to claim 2 wherein the motors are controlled and synchronised by a micro-processer, which is pre-programmed with set instructions and basic parameters, and can be programmed at each new operation with new values of variable data such as bag length and production rate.

4. A machine according to any preceding Claim wherein the brushless electric motor or motors provides integral magnetic braking for the draw roller.

5. A machine according to Claim 2 wherein the cam driven by the second motor is driven at constant speed through each operating cycle, while the first motor is switched on at the beginning and off half way through each operating cycle, the second motor producing one cam rotation per cycle with the cam positioned angularly to operate the knife when the first motor is off, and the film stationary over an anvil means.

6. A machine according to any preceding Claim wherein override means is provided, to enable an operator to increase the operating rate by a fixed proportion at each actuation of the override, and to enable an emergency stop to be effected.

7. A machine according to Claim 2, wherein a predetermined machine speed determines the rotational speed of the second motor, which remains constant, and the switching on and off of the first motor is in direct relationship to these speeds, and the detector sends a control signal to the first motor on sensing each registration mark, and the control means corrects any error or drift by driving the draw roller angularly further or less as required.

8. A machine according to Claim 7 wherein the control means is programmed so that if a predetermined number of registration marks is missed, the machine is shut down.

9. A machine for making plastics bags, substantially as hereinbefore described with refrence to and as illustrated in Figs. 2 to 5 of the accompanying drawings.

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